PHY105 Problems 4

1. At a particular time, a certain star has an altitude of 45° 29' and an azimuth of 180° when observed from Sheffield (latitude 53° 23' N). Calculate the azimuths at which the star rises and sets. [5]
[Hint: find the star’s distance from the North Celestial Pole, its *co-declination*. This is constant at all times. Also note that the star’s motion is symmetrical, so once you have calculated one azimuth by spherical trigonometry you should be able to derive the other without further trig.]

2. The star γ Draconis (Eltanin) was studied intensively in the 18th century because it happens to pass very nearly overhead in London (latitude 51° 29' N). Calculate the *minimum* altitude reached by γ Dra as seen from London. [2]

3. Walking home on September 29, I happened to notice that the nearly full Moon was very close to a bright “star”. On looking this up, I discovered that the “star” was the planet Jupiter. The altitude and azimuth of Jupiter at the time (8 pm) were 16° 00' and 152° 04' respectively, and the altitude and azimuth of the Moon were 17° 45' and 153° 54'. How far apart, in degrees, were the Moon and Jupiter? [3]

4. An amateur astronomer wishing to buy a “starter” telescope to make visual observations of the Moon and planets would probably be advised by a reputable dealer to buy an achromatic refractor, for example the 80 mm *f*/10 telescope we have considered in previous problems. On the other hand, research telescopes are all, without exception, reflectors. Explain why the small refractor is a better choice than a reflector for the beginner, and why (in contrast) it is better to use reflectors when a large telescope is desired. [5]

5. Explain the following terms as they apply to astronomical telescopes, illustrating your answers with appropriate diagrams:

* chromatic aberration; [2]
* coma; [2]
* spherical aberration; [2]
* astigmatism; [2]
* curvature of field. [2]